ABE12KX

12 W P1dB Extended Ku-Band BUC

USER MANUAL

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Scope

This document covers the installation, operation, and maintenance of the ABE12KFX BUC. It contains information intended for engineers, technicians and operators working with the block up converter.

To make inquiries, or to report errors of fact or omission in this document, please contact **Actox Corporation** at toll free 866-888-6087.

INTRODUCTION

The ABE12KFX is a reliable, high quality, cost efficient stand-alone block up converter. The application for this block up converter is Ku-Band VSAT communication in an outdoor environment. This line of superior products, engineered using state of the art technology, is characterized by unparalleled durability and dependability.

This is the smallest and lightest 12W L-To Ku-Band Block Up Converter and is designed to be mounted on the feed horn. The unit is ideal for portable and mobile applications. Double – L.O. feature makes unit universal for Ku-Band requirements. This is powered with +18 – 75VDC and consumes less than 86W.

KEY FEATURES

- **13.75-14.50 GHz**
- **950 to 1,700 MHz**
- **Smallest package size and weight**
- **Double L.O. (electronically and manually switchable 12.80 and 13.05GHz)**
- **Auto-ranging power 18-75 VDC**
- **Low power consumption**
- **Digital temperature compensation**
- **L.O. lock and amplifier LED**
- **M&C – combined RS-232/485/FSK(optional)**
- **Three-year warranty**
- **RoHS compliant**

ABE12KFX – 12W Ku-Band BUC monitors and controls numerous parameters and has features that make installation and use of the BUC simpler and enhance system performance.

Receiving and Inspection

The block up converter is designed to function outdoors and will arrive in a standard shipping container. Immediately upon receipt of the block up converter, check the packing slip against the actual equipment you have received. Inspect the shipping containers exteriors for visible damage incurred during shipping.

CAUTION!

Handle the block up converter with extreme care. Excessive shock may damage block up converter's delicate internal components.

Using the supplied packing list, verify that all items have been received and undamaged during shipment. Verify that all items are complete. If there are any omissions or evidence of improper packaging, please notify **Actox Corporation** immediately.

Equipment Damage or Loss

Actox Corporation is not responsible for damage or loss of equipment during transit. For further information, contact the responsible transport carrier.

When declaring equipment as damaged during transit, preserve the original shipping cartons to facilitate inspection reporting.

Return of Equipment

When returning equipment to **Actox Corporation** for repair or replacement:

1. Identify, in writing, the condition of the equipment,
2. Refer to the Invoice, Purchase Order and the date the equipment was received.

Notify Actox Corporation RMA department of the equipment condition and obtain a Return Material Authorization (RMA) number and shipping instructions.

NOTE

Do not return any equipment without an RMA number. *This is important for prompt, efficient handling of the returned equipment and of the associated complaint.*

Preparing for Installation

Before attempting to install or use the block up converter, we recommend that you first familiarize yourself with the product by reading through this manual. Understanding the operation of the system will reduce the possibility of incorrect installation, thereby causing damage or injury to yourself or others.

*The block up converter **must** be installed in accordance with the conditions and recommendations contained in the following sections.*

Safety Precautions

Carelessness or mishandling of the block up converter may damage the unit causing serious injury to yourself or others. Please adhere to the following:

WARNING!!

If your unit is equipped with an AC power cord and plug, do not tamper with, or attempt to reconfigure, the cord or plug supplied with the unit, as this can:

- *result in personal injury*
- *void the warranty*
- *Cause damage to the units or related equipment.*

INSTALLATION AND OVERVIEW

General Description

This section describes the installation and theory of operation of the block up converter.

ABE12KFX is powered by +18~+75 VDC via IF cable or MS connector

It will amplify an input signal from an L-Band RF source up to a power level of 12 Watts P1dB CW in Ku-Band.

The block up converter can be used as a stand-alone unit or in a redundant configuration.

Specifications

Table 1 summarizes the specifications of the ABE12KFX BUC. For mechanical specifications, refer to the outline drawing, Appendix 1.

General Considerations

The block up converter shall meet all specifications over full bandwidth and under all environmental conditions when terminated with a load of VSWR at 1.5:1 unless otherwise specified. All RF specifications shall be met within five minutes after applying power, except gain flatness, which shall be met after a warm-up period of ten minutes. During the warm-up period, the block up converter shall not exhibit any alarm or require an RF mute input signal to reset any alarm/fault latches.

Securing the block up converter

Align the block up converter output waveguide flange with the mating flange of the antenna feeder waveguide. Using the O-ring and hardware provided, connect the antenna feeder waveguide. Torque the flange screws to 16 inch-pounds (1.8 N-m). Attach the proper cables for waveguide for IF input, AC power and M&C if equipped to the corresponding connectors of the block up converter.

The cylindrical connectors are labeled clearly and have different pin layouts. It is impossible to incorrectly install the mating connectors.

Installing the Block-Up Converter

Tools and Test Equipment

Have on hand a standard electrician's tool kit and any tools listed in the antenna manufacturer's installation instructions.

Site Considerations

The BUC is designed to mount on the antenna. Locate and install the antenna according to instructions supplied by the antenna manufacturer. Choose an area that is free of extraneous interference from motors and electrical equipment and has a clear line of sight from the antenna to the satellite. Lightning arrestors should be used at the site to protect personnel and equipment.

Preparation

Mounting Considerations:

Optional Mounting Brackets are available that will facilitate mounting for most antennas.

The ODU must be mounted such that:

- Sufficient support is afforded to the BUC, the LNB and the Power supply to minimize the effects of antenna sway in strong winds.

- Air movement across the heat fins is possible.

- The fan of the BUC should be facing the ground when mounted.

- The fan intake and exhausts are free from any obstruction.

- The length of the Power supply cables is taken into consideration in determining the mounting location of the power supply.

> *Throughout installation and during any polarization, azimuth or elevation adjustment, ensure that cables and waveguide are not crimped or pinched.*

LED Indication

LED 1 indicator GREEN LED 2 L.O. indicator Yellow	SSPA OUT ENABLED L.O. 13.050GHz is set
LED 1 indicator GREEN BLINKING LED 2 indicator Yellow BLINKING	SSPA OUT DISABLED | L.O. 12.800GHz is set
LED 1 indicator RED	SUMMARY FAULT
No LED illumination	No power supply voltage

Connectors' Pin Assignment

Connector	Type	Pin #	Signal	Parameter
J1 "IF IN"	N-type female	N/A	IF Input 10 MHz Ref. IN	-0 dBm, max ±5 dBm
J2 "RF OUT"	WR-785	N/A	RF Output	44/ 47.0 dBm max
J3 "DC POWER IN"	MS3102A-10SL-4S 2 pin male	A	Line In (DC)	18-75 VDC
		B	Ground	
J4 "M&C Interface"	PT02E12-10P-027 10 pin male	A	Rx+ In	RS-485
		B	Rx- In	
		C	Tx+ Out	
		D	Tx- Out	
		E	Detector	0 - 875 mV (20W) 1360 mV (40W)
		F	Alarm Out	Low when alarm
		G	GND	
		H	Mute In	Muted when Low
		J	Rx In	RS-232
		K	Tx Out	RS-232

NOTE

10MHz Reference

The BUC must receive a stable external 10MHz reference provided by a stable signal source such as a signal generator, satellite modem or injected externally with a Bias T (for example, ABT6ARN/ABT6ARF manufactured by Actox Corporation) or a similar bias T type.

Please make sure to check the sticker on the BUC for the appropriate power source before any power connections are performed.

- **Powered via MS or IF Universal 18-72VDC**
  A universal powered unit is powered through a 2-pin MS mating connector (which is included with the BUC) or IF input by an external minimum 150W 24VDC or 48VDC power supply source.

- **Powered via only MS 18-75VDC**
  MS only powered unit uses a 2-pin MS mating connector (which is included with the BUC) with either a 24VDC or 48VDC external power source with at least 150W.

- **Powered via AC 80-240VAC**
  The AC only powered unit has a 3-pin AC connector (which is included with the BUC) and this unit must have its own dedicated power AC plug in power source.

Setting the L.O.

Switchable L.O. is mechanically changed by unscrewing the L.O. screw and pressing it in with any small object such as toothpick. If the BUC is equipped with M&C interface, the L.O. could be switching electronically with the appropriate M&C command.

L.O. Status LED

YELLOW	Standard LO 13.05 GHz
YELLOW (blinking)	Extended LO 12.80 GHz

Setting the TX and RX Frequencies

All transmit and receive frequencies are set in the modem.

For a direct connection to an L-band modem follow the manufacturer's instructions on setting the transmit and receive frequencies.

Ensure that it is safe to transmit prior to enabling the transmission.

Recommended Test Equipment

The following equipment or equivalent is recommended for installation and system alignment:

Equipment Type	
Spectrum Analyzer	HP8563E
Digital Voltmeter	Fluke 8050
Adapter Waveguide to coax	C or Ku-band
RF cables	With calibrated insertion loss up to 15GHz
40 dB attenuator	High Power to match HPA output.

Assortment of cables, connectors and adapters (calibrated up to 15 GHz)

Ensure that the BUC TX output power is disabled to prevent accidental transmission interference with adjacent satellites or transponders before attempting to align or performing any other operation involving the ODU. Before attempting any system change, carefully evaluate the possible effects of the transmitted signal.

Table 1 Specifications

TECHNICAL SPECIFICATIONS	
RF frequency **L.O. 13.05 GHz** **L.O. 12.80 GHz**	14.00 to 14.50 GHz 13.75 to 14.50 GHz
Local oscillator- switchable	13.05 GHz and 12.80 GHz
IF frequency	950 to 1,700 MHz
Output power @ P1dB min over temp.	12W (+41 dBm min)
IF connector	N-type or F-type (field-exchangeable)
Power supply - auto-ranging	+18~+75 VDC via IF cable, 65 W max
Internal 10MHz high stability reference	10^{-8}
Output interface	WR-75 G
Gain	65 dB min., 68 dB nominal
IMD3	-28 dBc max
L.O. leakage	-33 dBm max
Spurious	-50 dBc max
Gain variation **over 40 MHz** **over 500 MHz** **Over operating temperature**	1.1 dB p_p 1.4 dB p_p 1.2 dB p_p @ fixed frequency
Requirement for external reference	via IF cable
frequency	10 MHz (sine-wave)
input power	-5 to +5 dBm @ input port
Phase noise	-55 dBc/Hz max. @ 10 Hz -65 dBc/Hz max. @ 100 Hz -75 dBc/Hz max. @ 1 KHz -85 dBc/Hz max. @ 10 KHz -95 dBc/Hz max. @ 100 KHz -120 dBc/Hz max @ 1 MHz
Noise figure	20 dB max
Input V.S.W.R.	2 : 1 max
Output V.S.W.R.	2 : 1 max.
Mute	Shut off the BUC in case of L.O. unlocked
Input interface **ABE12KFX** **ABE12KFXF**	50 Ohm (N-type IF in) 75 Ohm (F-type IF in)
Status LED **RED** **GREEN** **YELLOW** **YELLOW blinking**	 Summary alarm All OK Standard L.O. 13.05 GHz Extended L.O. 12.80 GHz
Temperature range (ambient) operating storage	 -40 deg C to +55 deg C -40 deg C to +75 deg C
Dimensions & housing	120 (L) x 120 (W) x 77 (H) mm 4.72” (L) x 4.72” (W) x 3.28” (H)
Weight	1.4 kg (3.0 lbs) max

Connections and Mounting Hardware

The IF input connection requires a coaxial cable with an F or N type connector. The RF output requires a waveguide with a WR-75 flat flange. An O-ring shall be used to seal the waveguide connection.

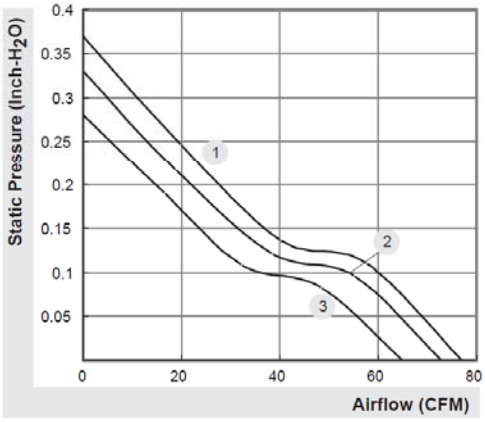
Assembly and Installation

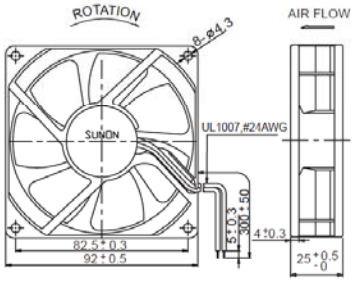
Use the information in this section as a guide to assemble and install the block up converter. The specified humidity is up to 100% during operation. However, installation should be carried out in dry conditions, free of salt spray or excessive humidity. This will eliminate the possibility of moisture and other foreign substances from entering the output waveguide flange.

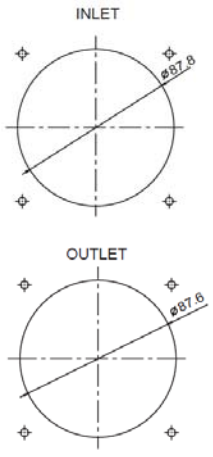
CAUTION!

Only authorized technical personnel should perform the Installation and proper electrical hookups of the block up converter.

The block up converter is designed to operate in an outdoor environment and is waterproof when mounted in the correct orientation. The block up converter contains high flow-rate fans (63.2 CFM) for cooling the block up converter. These fans function continuously during the operation. To provide a sufficient airflow, the block up converter should be mounted with a minimum clearance of 3 inches on all four sides and the bottom. Adequate cooling for the block up converter will provide years of top performance.







Functional Overview

General

This section describes the block up converter functions in detail. The functional overview explains the RF amplification, monitor & control and power distribution.

IF/RF Conversion and Amplification

The IF Input requires a signal with a 10MHz reference, and 18-75VDC enters the BUC by a coaxial cable, converted to Ku-Band by the BUC and goes through an internal isolator and reject filter, which provides a good VSWR at the input and minimizes spurious on receive band 10.95-12.75GHz. Under normal operation, the RF amplifier will amplify the RF Input signal level up to a power level of 41 dBm 12 Watts CW P1dB minimum.

To achieve the rated output power of the RF Amplifier, provide the necessary gain and low insertion loss. The amplified signal is transmitted through the output waveguide section to a satellite up-link system.

Monitor and Control (optional)

The block up converter may have a RS-485 and RS-232 serial interface. With this option the block up converter can communicate to the indoor unit or redundancy control block up converter via RS-485 or RS-232.

The control system can provide the following M&C functions:

- BUC Alarm (via RS-485/RS-232): when an input BUC within the block up converter system current draw is below 0.3A, a BUC alarm signal will be transmitted via the RS-485/RS-232 serial interface.
- Mute Control (via RS-485/RS-232)
- Mute Control (via hardware line): TTL high level signal will mute a block up converter
- Output Power Monitoring: 15 dB dynamic range (via RS-485/RS-232)
- Base Plate Temperature Monitoring (via RS-485/RS-232)

Operation

It shall be performed by authorized personnel prior to maintenance and/or repair.

Procedure

Verify that the installation procedure described was completed. A complete physical check of the customer's system is suggested.

WARNING!

The output power available at the output waveguide flange is extremely hazardous. Under ***no circumstances*** *should block up converter be operated without the waveguide feed or a high power load attached. Do not operate this equipment in the presence of flammable gases or fumes. Failure to observe this precaution will result in personal injury. Safe and careful installation of this block up converter will eliminate the possibility of accidents and provide years of top performance.*

Verify the antenna feed waveguide connection is properly done before the block up converter is energized.

NOTE

The block up converter can withstand any source or load VSWR. However, the block up converter will meet all specification requirements only if the source/load VSWR is sufficient. Normal operation is not possible if the antenna feeder VSWR is greater than 1.5:1.

Turn ON the power and allow a warm up period of twenty minutes before operating the block up converter. This will assure stable gain and power. The block up converter can function with a coupler when a direct measurement of the output power is made.

Maintenance

This section contains information on how to maintain, troubleshoot and repair the block up converter. The block up converter is extremely reliable, requiring very little preventive maintenance, or repair. Should there be a malfunction, this section also contains technical information to help diagnose basic failures.

Preventive Maintenance

WARNING!

Shut down the block up converter before disassembly and remove all cables and connectors. Failure to observe this precaution may result in personal injury or death. This includes the removal of any RF power originating from other system components.

When the block up converter is in the **hot** **stand-by mode** in a redundant system, switch it to the operation mode at least once every three months. Make sure the fan is running while in operation mode.

When the block up converter is in the **cold** **stand-by mode** in a redundant system, switch it to the operation mode at least once every three months. Make sure the fan is running while in operation mode.

Block up converter Cooling System Preventive Maintenance

Preventive maintenance is limited to checking the performance of the block up converter cooling system. No electrical or mechanical adjustments are required for normal operation.

The fan is the least reliable item in the block up converter. Wearing of the fan bearings will cause the RPM to drop and will create a higher than average heat-sink temperature. It is recommended to replace the fan after 3 years of operation.

Performance Check

Verify the system is properly set up. The power output at 1 dB compression shall be measured for evaluating the performance of the block up converter.

It is recommended to measure the following parameters for ensuring that the block up converter is in good working condition:

- Gain and Gain flatness
- RF load VSWR and RF source VSWR
- Two-Tone Inter-modulation Distortion
- Return Loss at connectors of the block up converter

Using a Source and an IF input signal level within the small signal region of the block up converter, measure the power level at connectors IF or MS connector. Plot the swept response on a test data sheet. From the plot, determine gain and gain flatness.

Plot the swept return loss for both the IF Input and RF Output signals on a test data sheet. From the plot determine the return loss.

From the output power measurements determine P1dB. Record value on a test data sheet.

Measure the Two-tone Inter-modulation Suppression using two equal signals separated by 5 MHz. Record value on test data sheet.

WARNING!!

Cable connection and disconnection shall be done carefully to avoid physical damage to the cables and connectors, which may cause intermittent problems in the future.

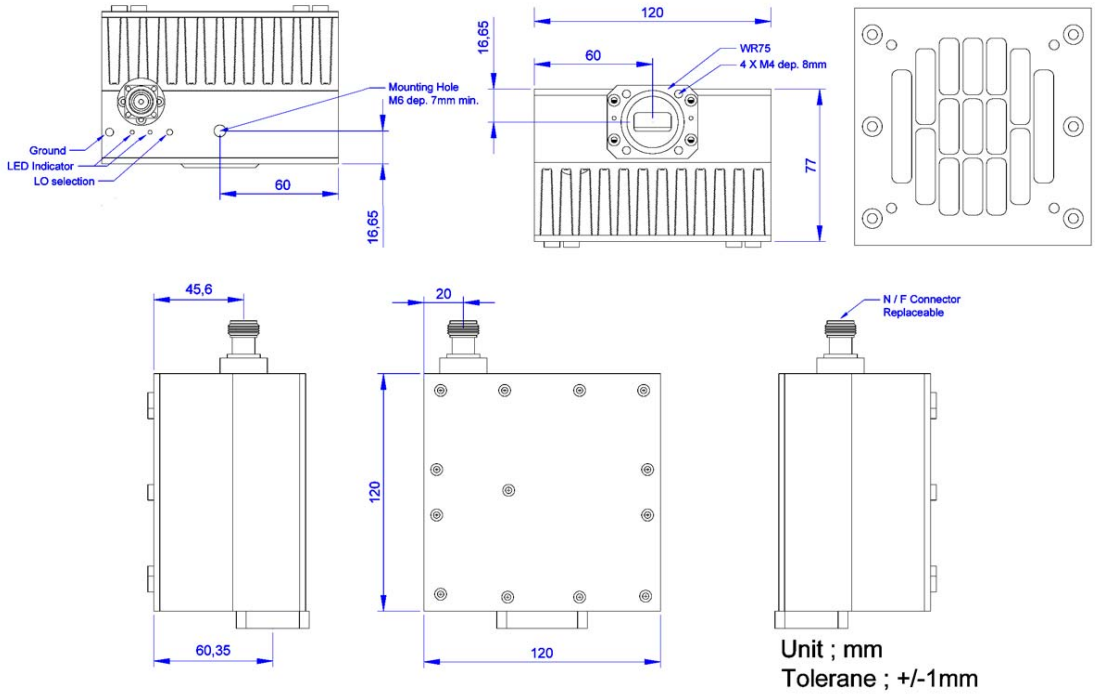
Symptom	**Action**
Fails performance test	Check power source, RF source, cabling and connectors. Check LED indicators for status and if the light is red contact Actox Corporation. If we are not able to assist you remotely, return block up converter to Actox Corporation after RMA number has been issued.

Out-of Warranty Repair

A non-warranty and out-of-warranty repair service is available from Actox Corporation for a nominal charge. The customer is responsible for paying the cost of shipping the BUC both to and from Actox Corporation for these repairs.

Appendix 1

Mechanical Drawing



Appendix 2

Spare Parts

The following sheet can be copied and used as a fax form to order the required spare parts.
Please make sure to include all identifying information to facilitate the processing of your order.
The order may be sent via email to the following address.

Fax: 1-866-888-6087
Email: mark_moore@actox.com

For additional information, please contact our customer service department at:
(619)906-8893 or 1-866-888-6087

Actox Corporation

designers and manufacturers of telecom & wireless products

Spare Parts Order Form

ABE12KFX Ext. Ku-Band BUC

From:			
Place By:		**Signature:**	
Telephone:			
Fax		**Email:**	

Part Description	Part Number	Quantity	Unit Price*	Line Total*

Fax to: Customer Service 1-866-888-6087

Appendix 3

M&C Commands

Reply	Packet format	Explanation	Interpretation	Examples
ACK (Acknowledge	7E FX E0 ZZ 7F	Acknowledge that the received packet was properly processed.	X = Device address of the packet source device. ZZ = CRC.	1) reply: 7E FF E0 E0 7F (ACK reply sent from the BUC)
NACK (Not Acknowledge)	7E FX F1 YY ZZ 7F	Indicate that a problem was encountered with the received packet.	X = Device address of the packet source device. YY = Error code (03 = Incorrect CRC 18 = Unrecognized command 30 = Set command attempted on a restricted database element) ZZ = CRC.	1) reply: 7E FF F1 03 F2 7F (NACK reply sent from the BUC for an invalid CRC) 2) reply: 7E FF F1 18 E9 7F (NACK reply sent from the BUC for an unrecognized command).

Command	Packet format	Explanation	Possible replies	Interpretation	Examples
Get Device Temperature	7E FF 02 06 06 02 7F	Query device for current temperature	**Update Device Temp:** 7E FF 84 06 06 TT TT ZZ 7F	TT TT = Device temp in °C + 273. ZZ = CRC.	1) cmd: 7E FF 02 06 06 02 7F reply: 7E FF 84 06 06 01 02 87 7F (Temp = 0x0102 = 0d258 – 273 = -15°C) 2) cmd: 7E FF 02 06 06 02 7F reply: 7E FF 84 06 06 01 34 B1 7F (Temp = 0x0134 = 0d308 – 273 = +35°C)
Get Power Supply Temperature	7E FF 02 06 07 03 7F	Query device for current power supply temperature	**Update Device PS Temp:** 7E FF 84 06 07 TT TT ZZ 7F	TT TT = PS temp in °C + 273. ZZ = CRC	1) cmd: 7E FF 02 06 07 03 7F reply: 7E FF 84 06 07 01 02 86 7F (Temp = 0x0102 = 0d258 – 273 = -15°C) 2) cmd: 7E FF 02 06 07 03 7F reply: 7E FF 84 06 07 01 34 B0 7F (Temp = 0x0134 = 0d308 – 273 = +35°C)
Get Output Power	7E FF 02 17 FF EA 7F	Query device for current output power	**Update Output Power:** 7E FF 84 17 FF PP PP ZZ 7F	PP PP = Output power in 10 x dBm. ZZ = CRC.	1) cmd: 7E FF 02 17 FF EA 7F reply: 7E FF 84 17 FF 01 2C 41 7F (Power = 0x012C = 0d300 = 30.0dBm.) 2) cmd: 7E FF 02 17 FF EA 7F reply: 7E FF 84 17 FF 01 A0 CD 7F (Power = 0x01A0 = 0d416 = 41.6dBm.)
Get Gain	7E FF 02 18 FF E4 7F	Query device for current gain. Note: value is depending of attenuation settings.	**Update Gain:** 7E FF 84 18 FF GG GG ZZ 7F	GG GG = Gain in 10 x dB. ZZ = CRC.	1) cmd: 7E FF 02 18 FF E5 7F reply: 7E FF 84 18 FF 02 8A 69 7F (Gain = 0x028A = 0d650 = 65.0dB.) 2) cmd: 7E FF 02 18 FF E5 7F reply: 7E FF 84 18 FF 01 F9 F7 7F (Gain = 0x01F9 = 0d505 = 50.5dB.)
Get Attenuation	7E FF 02 18 FE E4 7F	Query device for current attenuation	**Update Attenuation:** 7E FF 84 18 FE GG GG ZZ 7F	AA AA = Attenuation in 10 x dB. ZZ = CRC.	1) cmd: 7E FF 02 18 FE E4 7F reply: 7E FF 84 18 FE 00 C8 AA 7F (Atten = 0x00C8 = 0d200 = 20.0dB.) 2) cmd: 7E FF 02 18 FE E4 7F reply: 7E FF 84 18 FE 00 69 0B 7F (Atten = 0x0069 = 0d105 = 10.5dB.)
Get Low Power Alarm Threshold	7E FF 02 10 10 02 7F	Query device for current low power alarm threshold	**Update Low Power Alarm Threshold:** 7E FF 84 10 10 TT TT ZZ 7F	TT TT = low power threshold in 10 x dBm. ZZ = CRC. Note: zero value means low power alarm disabled	1) cmd: 7E FF 02 10 10 02 7F reply: 7E FF 84 10 10 01 AE 2B 7F (Thresh = 0x01AE = 0d430 = 43.0dBm.) 2) cmd: 7E FF 02 10 10 02 7F reply: 7E FF 84 10 10 00 00 84 7F (Thresh = 0x0000 = 0d00 = alarm is disabled.)
Get Power Supply Voltage	7E FF 02 06 10 14 7F	Query device for power supply voltage	**Update PS Voltage:** 7E FF 84 17 FF PP PP ZZ 7F	VV VV = PS voltage in 10 x V. ZZ = CRC.	1) cmd: 7E FF 02 06 10 14 7F reply: 7E FF 84 06 10 01 2C BF 7F (Power = 0x0064 = 0d100 = 10.0V.) 2) cmd: 7E FF 02 06 10 14 7F reply: 7E FF 84 06 10 00 63 F1 7F (Power = 0x0063 = 0d99 = 9.9V.)

Command	Packet format	Explanation	Possible replies	Interpretation	Examples
Get Power Supply Current	7E FF 02 06 11 15 7F	Query device for power supply current	**Update PS Current :** 7E FF 84 06 11 PP PP ZZ 7F	CC CC = PS current in 10 x A. ZZ = CRC.	1) cmd: 7E FF 02 06 11 15 7F reply: 7E FF 84 06 11 00 AD 3E 7F (Power = 0x00AD = 0d173 = 17.3A.) 2) cmd: 7E FF 02 06 11 15 7F reply: 7E FF 84 06 11 00 97 04 7F (Power = 0x0097 = 0d151 = 15.1A.)
Get Mute Status	7E FF 02 06 01 05 7F	Query device for mute status	**Update Mute Status:** 7E FF 84 06 01 00 MM ZZ 7F	MM = Mute status (0 = enabled; 1 = muted). ZZ = CRC.	1) cmd: 7E FF 02 06 01 05 7F reply: 7E FF 84 06 01 00 00 83 7F (Device is enabled.) 2) cmd: 7E FF 02 06 01 05 7F reply: 7E FF 84 06 01 00 01 82 7F (Device is muted.)
Get Device Address	7E FF 02 03 04 05 7F	Query for device address	**Update device address:** 7E FF 84 03 04 00 XX ZZ 7F	XX = Device address. ZZ = CRC.	1) cmd: 7E FF 02 03 04 05 7F reply: 7E FF 84 03 04 00 0A 89 7F (Device address = 0xA) 2) cmd: 7E FF 02 03 04 05 7F reply: 7E FF 84 03 04 00 0E 8D 7F (Device address = 0xE)
Get Over Temperature Alarm	7E FF 02 00 02 00 7F	Query device for over temperature alarm	**Update over temperature alarm:** 7E FF 84 00 02 00 XX ZZ 7F	XX = Alarm state (0 = no alarm; 1= alarm). ZZ = CRC.	1) cmd: 7E FF 02 00 02 00 7F reply: 7E FF 84 00 02 00 01 87 7F (Over temp alarm is raised) 2) cmd: 7E FF 02 00 02 00 7F reply: 7E FF 84 00 02 00 00 86 7F (Over temp alarm is clear)
Get Low Power Alarm	7E FF 02 00 05 07 7F	Query device for low power alarm	**Update low power alarm:** 7E FF 84 00 05 00 XX ZZ 7F	XX = Alarm state (0 = no alarm; 1 = alarm). ZZ = CRC.	1) cmd: 7E FF 02 00 05 07 7F reply: 7E FF 84 00 05 00 01 80 7F (Low power alarm is raised) 2) cmd: 7E FF 0200 05 07 7F reply: 7E FF 84 00 05 00 00 81 7F (Low power alarm is clear)
Get Summary Alarm	7E FF 02 00 0F 0D 7F	Query device for summary alarm	**Update summary alarm:** 7E FF 84 00 0F 00 XX ZZ 7F	XX = Alarm state (0 = no alarm; 1 = alarm). ZZ = CRC.	1) cmd: 7E FF 02 00 0F 0D 7F reply: 7E FF 84 00 0F 00 01 8A 7F (Summary alarm is raised) 2) cmd: 7E FF 02 00 0F 0D 7F reply: 7E FF 84 00 0F 00 00 8B 7F (Summary alarm is clear)

Command	Packet format	Explanation	Possible replies	Interpretation	Examples
Set Mute Control	7E FF 14 13 01 00 MM ZZ 7F	Mute / Unmute the device.	**ACK NACK**	MM = Mute control (1 = Mute; 0 = enable). ZZ = CRC	1) cmd: 7E FF 14 13 01 00 01 07 7F reply: ACK (Mute device) 2) cmd: 7E FF 14 13 01 00 00 06 7F reply: ACK (Enable device)
Set Attenuation	7E FF 14 18 FE AA AA ZZ 7F	Set internal attenuator value Note: value is internally rounded with 0.5dB discrete, value range is 0-20 dB.	**ACK NACK**	AA AA = Attenuation in 10 x dB. ZZ = CRC.	1) cmd: 7E FF 14 18 FE 00 C8 3A 7F reply: ACK (Set attenuator to 20.0dB = 0d200 = 0x00C8) 2) cmd: 7E FF 14 18 FE 00 69 9B 7F reply: ACK (Set attenuator to 10.5 dB = 0d105 = 0x0069)
Set Low Power Alarm Threshold	7E FF 14 10 10 TT TT ZZ 7F	Set low power alarm threshold Note: zero value means low power alarm disabled	**ACK NACK**	TT TT = Low power threshold in 10 x dBm. ZZ = CRC.	1) cmd: 7E FF 14 10 10 00 C8 DC 7F reply: ACK (Set threshold to 43.0dB = 0d430 = 0x01AE) 2) cmd: 7E FF 14 10 10 00 00 14 7F reply: ACK (Set threshold to 0.0 dB = 0d00 = 0x0000) – alarm disabled
Set Device Address	7E FF 14 03 04 00 XX ZZ 7F	Set device address Note: (0 ≤ address ≤ 0xE	**ACK NACK**	XX = Device address. ZZ = CRC.	1) cmd: 7E FF 14 03 04 00 0A 19 7F reply: ACK (Set device address to 0xA) 2) cmd: 7E FF 14 03 04 00 0E 1D 7F reply: ACK (Set device address to 0xE)

Command	Packet format	Explanation	Possible replies	Interpretation	Examples
Get L.O. Frequency	7E FF 02 10 12 ZZ 7F	Query device for L.O. Frequency	**Update** L.O. frequency 7E FF 84 10 12 QQ QQ ZZ 7F	QQ QQ =L.O. Frequency In HEX format ZZ = CRC	1.cmd: 7E FF 02 10 12 ZZ 7F reply: 7E FF 84 10 12 13 24 ZZ 7F (Frequency = 0x13 24=0d4900 MHz) reply: 7E FF 84 10 12 15 7C ZZ 7F (Frequency= 0x15 7C = 0d5500 MHz)
Get L.O. 1 or L.O. 2	7E FF 02 10 11 ZZ 7F	Query device for L.O. 1 or L.O. 2.	Update L.O.1 or L.O.2 7E FF 84 10 11 00 LL ZZ 7F	LL = 00 = L.O.1 LL = 01 = L.O.2 ZZ = CRC	1.cmd: 7E FF 02 10 11 ZZ 7F reply: 7E FF 84 10 11 00 00 ZZ 7F (LL = 00 = L.O.1) reply: 7E FF 84 10 11 00 01 ZZ 7F (LL = 01= L.O.2)
Set L.O. 1 **Set L.O. 2**	7E FF 14 10 11 00 00 ZZ 7F 7E FF 14 10 11 00 01 ZZ 7F	Set the frequency of L.O. 1 Set the frequency of L.O. 2	ACK 7E FX E0 ZZ 7F	X = device address of the packet source device ZZ = CRC	1.Reply 7F FF E0 ZZ 7F ACK reply sent from the device